

**OBSERVATIONS ON THE SOUTH AUSTRALIAN MEMBERS OF THE
SUBGENUS, "WALLABIA."**

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PLATES XVI. TO XVIII.

INTRODUCTION.

The genus *Macropus* (Shaw), in spite of its immense geographic range, exhibits very little structural variation. The subdivision of its twenty-three species, which has been generally accepted, is that introduced by Oldfield, Thomas (1) in 1888, who made bodily size the chief criterion of eligibility in three groups known respectively as Kangaroos, Large Wallabies, and Small Wallabies. Bodily size was defined chiefly by reference to the length of the pes and the basal length of the skull, and a member of the genus was said to be a kangaroo when the length of its foot exceeded 260 mm. and the basal length of its skull 135 mm.; a large wallaby when these measurements fell between 160-250 mm. and 108-130 mm. respectively; and a small wallaby when the foot was less than 160 mm. and the skull 108 mm. long.

This classification is rendered less arbitrary and given some systematic sanction by the fact that bodily size is correlated, to some extent, not only with certain cranial and dental characters, although these are of a minor kind, but also with habits and distribution, and the three groups of Thomas have been replaced in recent usage by three co-extensive subgenera, *Macropus* s.s., *Wallabia*, and *Thylogale*.

The cleavage between *Macropus* s.s. and the smaller species is, on the whole, more definite than between *Wallabia* and *Thylogale*, and the status of one or two species of these last may need revision when the examination of large series and, particularly, the extension of field observations, permit of more precision in the statement of average specific characters.

The great variation in adult size of many of the Macropods is well known to those who have made many measurements of specimens in the flesh, and aged males of both sections of wallabies frequently transgress the limits of the subgenera as stated above.

In addition to the characters mentioned the species of *Wallabia* are further distinguished both from *Macropus* and *Thylogale* by the relatively greater length of the tail, the distal portion of which is commonly clothed by hairs which are longer and more loosely applied, and by the greater richness and variety of their ornamentation. Eight well-defined species, separated both by external and cranial characters, constitute the group, and many varieties have been described. Of these, eleven subspecific forms are allowed by Cabrera (2), but it is probable that the examination of larger series, with due consideration of seasonal changes in pelage, will result in a further reduction in their number.

Six of the species are confined to the Australian mainland, one occurs also in several islands of the north coast and in New Guinea, and, the last to be described, the remarkable *M. wellsbyi* of Longman (3) appears to be an exclusively insular form.

The geographical range of the group is a wide one, and embraces areas of widely different character as regards topography, vegetation, and climate; but it

is noteworthy that none of the species have succeeded in adapting themselves to arid conditions, and most of them show marked preference for well-timbered districts of high rainfall. Their occurrence may therefore be said, in a general sense, to be coastal rather than inland, and the chief gap in its continuity exists on the south coast, between the meridians 120° and 135° E., where the Nullarbor Plain and the adjacent drylands, east and west, extend right to the seaboard.

In South Australia two members of the subgenus, *M. ruficollis typicus* and *M. greyi* have long been known to exist, and a third, *M. ualabatus* (*W. bicolor*), has recently been claimed as a member of the fauna of the State by Professor Wood Jones (4), although the evidence in support of its status as an indigine is slight.

The literature relating to these South Australian wallabies is very scanty, and since the observations of Gould (5) on *M. greyi* and the bare record of the occurrence of *M. ruficollis typicus*, by Zietz (6), nothing appears to have been published in regard to them till the appearance in 1924 of F. Wood Jones' "Mammals of South Australia." In this last, for reasons connected with the scope and purpose of the book, their treatment was necessarily brief, and much remains to be done in the way of defining their local distribution, their present position in the fauna, and recording such details of their habits and natural economy as can be gleaned.

The need for so doing is increased by the fact that *M. greyi* is almost exclusively South Australian in occurrence, has many peculiar characters which render it very distinct, and is at present on the very verge of extinction, while in the case of *M. ruficollis typicus* the South Australian animal is the extreme westerly representative of a species which has been studied from eastern material only, and which, although still well established elsewhere, is here greatly reduced in numbers, and until recently was unrepresented in the State Museum.

Apart from the rapid disappearance of the animals themselves, another factor which lends urgency to the need for a more complete record is the equally rapid passing of the generation of men who knew them in the day of their plenty and whose circumstances in the early days of the colony brought them intimately in contact with the fauna under conditions which were very favourable for observation. Indeed, the purpose of the writer is as much to make public the impressions and opinions of these pioneers, as to record the somewhat meagre results which accrue from observations to-day, under circumstances which the advance of settlement has made comparatively adverse.

In South Australia the subgenus occupies but a small fraction of the total area of the State, and to that extent it is not an important element in its fauna.

At the time of the first settlement of the colony it is probable that its range was constituted by all that portion of the State which lies east of the 139th meridian and south of the 35th parallel, but its distribution throughout this tract was not uniform, and showed, rather, an increasing density from north to south and, probably, also a considerable hiatus in the mallee country of its north-eastern corner.

Both species appeared to have crossed the Murray, but the extent of their tenure of the river flats is difficult to estimate, and from this north-western part of their range they were early driven, or greatly reduced, by the rapid advance of closer settlement. Their former presence in the lower part of the county of Sturt is vouched for by many residents of that part of the country still living, but I have been unable to gather any reliable evidence of their occupation of any part of the Mount Lofty range system. A small wallaby, probably the mainland *M. eugenii* (now extinct), was well known in the hill country, but this species, together with the black-faced kangaroo, *M. giganteus*, var. *melanops*, seem to have been the only members of the genus in the highlands south of the 35th parallel. In the case of *M. greyi*, this failure to occupy the hill country might be antici-

pated from what is known of its habits, but with *M. ruficollis* it is somewhat remarkable, as the same species in eastern Australia is to be found well established in rugged mountainous country, where the climate is much more rigorous and conditions of forage far less attractive than in many parts of the Mount Lofty range.

With the exception caused by the vacation of Trans-Murray district, the range of the subgenus in South Australia remains much as before, but throughout the whole its members have been greatly reduced, and over large areas have disappeared altogether.

The tract of country defined above is made up of the whole of the South-eastern Division of the State, plus the south-western portion of the Murray Mallee Division, and, judged by its topography and vegetation, may be divided into an upper and lower district. The upper district forms part of what has come to be known as the Ninety-mile Desert, and, with a few inconsiderable oases, is characterised by a uniform sandy soil and an undulating surface which rises at frequent intervals to form sharp ridges, sometimes of exposed limestone, more frequently of sand. Between the ridges are long trough-like depressions or flats, and occasional claypans in the latter provide the site for the infrequent surface waters of the area. The ridges are commonly bare or, at most, sparsely clothed with dwarf banksias and casuarinas, but the flats and gullies are rather densely covered by very stunted mallee. Although not without a certain grim attraction, the general aspect of the country is in keeping with its name, and, in spite of the fact that the mallee is not altogether destitute of undergrowth and the rainfall is nowhere less than 15 inches, its grazing value is low, and it remains the most sparsely settled area south of Adelaide.

The absence of any abrupt transition renders it difficult to set a southern limit to this type of country, but the counties of MacDonnell, Robe, and Grey may be said to constitute a second lower district which, on the whole, is in marked contrast to the upper. This is a notably flat, low-lying area with a rainfall increasing from 20 inches in the north to over 30 inches in the extreme south, and it affords far greater variation in the types of its soils and vegetation than the upper. These variations are most noticeable when the country is traversed from east to west, and it may be said to consist of comparatively narrow strips of rich loams or silts rapidly alternating with poor sands, and in the south the former merge with the wider areas of volcanic soils about Mount Gambier and Millicent.

Both types of country were, originally, well timbered, but with quite distinct species, the sandy stretches supporting the rough-barked *E. viminalis* (locally called a stringy-bark), in belts or clumps which are isolated from one another by open heaths of small xanthorrhoeas, leptospermums, and banksias (*B. ornata*), while the richer country is more densely and uniformly clothed by smooth-barked eucalypts (chiefly *E. rostrata* and *E. leucoxylon*), together with the large *Banksia marginata* or honeysuckle. Here the undergrowth is practically absent, being replaced by grasses, and in encouraging the growth of the latter by felling the timber the face of the country, in certain parts of the district, has been completely changed during the period of settlement.

In the sandy country the surface is frequently elevated to form low ridges, usually running north and south, and these are densely timbered and clothed also with a thick undergrowth of bracken (*Pteridium* sp.), interspersed with the smaller species of the surrounding heath. These ridges are locally dignified by the name of "ranges," but few of them are high enough to break the flat monotony of a general view. The coastal belt is distinct from either of these two main types of country and for many miles is backed by low ranges, of which the Woakwine and Black Ranges are the most considerable. On the more northerly of these hills the mallee, characteristic of the desert, reappears, but, in general, eucalypts

are less in evidence here than melalucas, and in many places on the eastern slopes acacias and melalucas, either singly or in combination, form dense tangled thickets of a kind not represented further inland.

Although destitute of permanent streams, the whole of the lower district is particularly well favoured with subterranean water supplies, which are tapped, in most localities, with the greatest ease and which supply permanent waterholes, both artificial and natural, scattered liberally over the whole face of the country. In this respect the lower district contrasts strongly with the upper in which surface waters are both few and fugitive, and the contrast is heightened when in winter, from causes not entirely dependent on the local rainfall, great areas of low-lying country are converted into swamps.

From the faunal point of view the lower district is of far greater importance than the upper, and the combination of rich, well-watered grasslands, flanked everywhere by the scrubby "ranges" and wide heaths, with its consequent attractions of easy forage and shelter, has in the past supported a marsupial population which in variety and density is equalled by few other areas in Australia.

PART I.

MACROPUS (WALLABIA) GREYI. (Gray, 1843.)

History.—This wallaby appears to have been first brought under notice by Sir George Grey, who, while Governor of the colony, presented skins and skulls of a male and female to the British Museum. These specimens were listed in 1843 by J. E. Gray (7) and the species named in honour of the donor, but the first extended description is that of Waterhouse (8) in 1846. Gould collected the animal in the south-east of South Australia, and in 1863 (5) published some account of its habits and figured it in two beautifully-coloured plates. In 1888 Oldfield Thomas (1) redescribed the species and drew attention to the cranial characters which distinguish it from its associates in the subgenus. Wood Jones (9) in 1925 described the hair-tracts of the pouch-young, and redescribed (4) the external characters of the adult from material in the South Australian Museum, giving at the same time some measurements of the skulls available, and brief notes on its natural history. In addition to these major contributions, the species is mentioned in several lists and compilations such as those of Krefft, Zietz, and Lydeker, without, however, anything being added to what was already known.

Although the descriptions of Waterhouse, O. Thomas, and Wood Jones have embraced most of the external characters of the species, the examination of fresh material acquired by the South Australian Museum, the examination and photographing of a living example on several occasions, and, more particularly, the weighing and sifting of information gathered during seven years from residents of long standing in the South-eastern District, enables the writer to confirm much that has been written, and to add a little to these previous accounts.

Distribution in the past, and present position in the Fauna.—The former range of *M. greyi* in South Australia (1) was approximately that of the subgenus as defined above, but the extent of its occurrence northwards is difficult to ascertain, owing partly to the confusion which is introduced by the application of different popular names to the same species in different districts; thus, whereas in the lower district and in the "desert" the present species was invariably known as "Toolach", (2) across the Murray this name was given also to a much smaller

(1) The species was not exclusively confined to South Australia, but occurred also through a small strip of Victorian territory contiguous to the border.

(2) Although presumably aboriginal in origin, I have been unable to obtain reliable information as to the etymology of this word; the spelling adopted here is that of Wood Jones, but it may be noted that, by the majority of settlers, the word is pronounced Toe-lait-shee, with the accent on the second syllable.

wallaby than *M. greyi*, probably the mainland form of *M. eugenii*. Nevertheless, the striking characters of the Toolach early attracted the attention of the settlers, and the fact of its inhabiting relatively "open" country easily accessible from, and indeed often contiguous to, the settled areas, has made it one of the best known native animals throughout its habitat. It can scarcely be said that the memories of the "Old Timers" have yielded up a wealth of information regarding it, but there is an approach to unanimity in the main features of their accounts which is conspicuously absent from the impressions left by many other more obscurely living species.

The Toolach was essentially a clear-country wallaby, avoiding both heavy timber and thick scrub, and in all parts of its range showed a marked partiality for grass country, not simply as a feeding-ground, but as a "beat" in which practically the whole time of the animal, both feeding and resting, was spent. In the typical desert country of the counties of Russell and Buccleuch, where grass flats are few and far between, it occurred but sparsely, and here appeared to be comparatively solitary, but in the lower south-east, where richer soils permit a far greater development of grasses, its undoubted instinct towards gregariousness asserted itself, and when the country was first settled it was here established in a series of isolated colonies, moderately well delimited and very frequently situated on what is known locally as the "fringe" or "Black Rush" country (pl. xvi., fig. 1). This may be described as a transition belt between the light sandy soils and the richer loams and clays; between the stringy-bark and heath, on the one hand, and the smooth-barked gum and grass country on the other. Flat, or at most gently undulating, these areas become swampy in winter, and the depressions are filled by a low matted growth of small rush (*Lepidosperma laterale*) which earns for the locality one of its local names. Alternating with the rush are patches of tall, coarse grasses, the most conspicuous of which are *Poa caespitosa* and the so-called kangaroo grass, *Themeda triandra*. There is little big timber, but honeysuckle (*Banksia marginata*) occurs both singly and in little groves, and there are frequent clumps of dwarf *Xanthorrhoea* and the little *Banksia ornata*. Although "fringe" country is very extensive in the district, the whole of it was not occupied by Toolaches, the groups of which showed marked partiality for certain quite restricted areas, from which they were only driven by persistent persecution, and to which they returned again and again. In spite of many changes caused by closer settlement of the country, the sites of many of these Toolach colonies are still well remembered, though the wallaby itself has long gone.

It has been stated that the Toolach was at one time exceedingly numerous and, for instance, "swarmed in the neighbourhood of Kingston" (4), but in accepting these statements it is necessary to bear in mind that they apply to relatively small areas only, and a considerable weight of evidence inclines me to the belief that in point of numbers *M. greyi* fell far short of the four other species of *Macropus* in the district. Although human persecution and the occupation of its chosen country early reduced its numbers and broke up and dispersed its larger colonies, it was still far from uncommon even as late as 1910, and scattered bands were still to be found in suitable localities. The chief of these were along the edges of the long strip of grass country extending from a little north of Millicent to the vicinity of Bull Island and Reedy Creek, and known locally as the Avenue Valley, on the Biscuit Flat between Robe and Kingston, the Mosquito Plain between Naracoorte and Penola, and in the country between Clay Wells and Connurra, and probably also in the sandhill country of its northern district. Its rapid disappearance in the last twenty years may be attributed with some confidence to the invasion and enormous increase of the English fox, which has been proved without doubt to take a heavy toll of the young, even of the large kangaroos, and indeed in the almost unoccupied desert country where man has had little influence on its

destinies, it seems that the fox has been the sole factor in effecting its extermination. Its chief natural enemies before the advent of the white man and the fox seems to have been the wedge-tailed eagle (*Uroaetus audax*), which, like the latter, chiefly attacked the young. These attacks were by no means always successful, and were sometimes thwarted by the courage of the females. Mr. Andrew Robson, of Robe, on whose property of "Comung" the species was once well established, relates that he once witnessed such an attack, in which the eagle, flying very low, persistently followed a female with a large joey. The bird manoeuvred continually with the patent intention of keeping the two separate, and the whole energies of the doe were equally obviously bent on preventing this separation, but her task was rendered difficult by the frequent panic-stricken rushes and bewildered halts of the joey. Matters continued thus for several minutes when one such rush brought the latter within striking distance; but as the bird dropped to 3 feet to seize him the doe sprang at the attacker, and with both hind feet struck the peculiar slashing blow common to most of the macropods. Whether the blow went home or not the observer was not able to see, but the sally was sufficiently disconcerting to cause the wedge-tail to beat a retreat, during which the joey regained the doe's pouch and with it safety.

The outcome of these encounters was not usually so satisfactory (to present-day sentiments), and I learn from another source that small boys in a certain district were in the habit of periodically visiting the sites of eagles' nests to recover the scalps from the remains of young Toolaches to be found lying underneath; this at a time when a bonus of sixpence was paid on all marsupial scalps.

By 1923 the species had become exceedingly rare. Isolated pairs were no doubt scattered through the rougher stringy-bark country, but the sole remnant of the Toolach population which continued living in country and under circumstances which might be regarded as typical of that formerly obtaining, was a small band of perhaps fourteen individuals, located on the south end of Konetta sheep run, some twenty-six miles south-cast of Robe.

Public attention was first called to the rapidly approaching extinction of the Toolach by Professor Wood Jones, who repeatedly stressed the urgent need for rigid protection of this group at Konetta. In May, 1923, as there appeared little prospect of effective conservation in the south-cast, an organised attempt was made on a considerable scale to capture living specimens for transference to the sanctuary on Kangaroo Island. This, and a later attempt in 1924, failed in their main objective, since as a result of overmuch driving the four examples obtained were either dead or died shortly after capture, but were not altogether fruitless, as much-needed Museum material was thus acquired.

The subsequent history of the species consists of a resumption of the exterminating process. Owing to the extensive publicity given to the two expeditions noted above, local attention was focussed on the Toolach to a degree hitherto unknown. Much of this attention was undoubtedly sympathetic to the idea of conservation, but the realization of the great rarity of the wallaby roused the cupidity of an unscrupulous few, and that survivors of the 1924 attempt have been wantonly killed for the sake of the pelt as a trophy, is an assertion based on the admission of at least one of the slayers. The constant hunting of foxes with dogs over the Toolach country has been made the excuse for some of this killing, the plea being advanced that it is impossible to prevent the dogs running anything and everything that is put up. The pretext is a flimsy one, however, and not only is there an obvious expedient in avoiding the locality altogether, but interrogation usually elicits the fact that "nothing spoils a dog like checking him." This peculiar solicitude for the dog's training has borne very heavily on the Toolach and still bears very heavily on his cousin the brusher. Occasionally, however, a better spirit prevails, and recently a Toolach doe was promptly rescued from two

kangaroo dogs which had seized her, and, in the patient care of Mr. J. Brown, of Robe, she has survived the rough handling received. She may well represent the last of her race in this State, as a careful and extended examination of the beat of the Konetta band by the writer in February of this year failed to reveal any recent traces, either in the shape of tracks or dejecta, and the opinion is expressed by the resident who knows the country best that the band has been entirely extirpated.

The species is very poorly represented in Museums, and enquiries recently instituted in all the States indicate that there are six skins and seven skulls in the public collections of Australia; of these, four skins and five skulls are preserved in the South Australian Museum.

Habits.—Apart from the semi-gregariousness mentioned in discussing its local distribution, in the main features of its habits relating to such routine matters as feeding, lying up, and breeding, *M. greyi* appears to have offered little of contrast with the other members of the genus. On the other hand, in many of its physical attributes the species is markedly distinct from all others in eastern Australia, and, as already mentioned, this fact has been instrumental in creating unusually clear impressions regarding it. Three attributes have chiefly served to create this impression—its speed, its gait, and the elegance of its form and bearing and ornamentation.

The speed of the Toolach is a matter which has become almost traditional in the districts which it formerly inhabited, and the regular coursing of the wallaby with dogs has provided the material for a rich fund of anecdote. That it was by far the swiftest of all the native animals in the district is the universal testimony of those who have coursed it, but the attempt to set up a standard of comparison by means of which its speed may be more strictly defined is a matter of difficulty owing to the variety and heterogeneous breeding of the dogs used in its chase.

After sifting the evidence from a great many independent sources, it may be accepted that in open grass country, on firm, dry soil, and with a close-up start, the chances were somewhat heavily against a Toolach holding its own with a greyhound, and a somewhat sticky soil confers a further advantage on the latter. This is not to say, however, that such runs, even under these conditions (when the dog is prepared and the wallaby probably not), were always fatal to the wallaby. There appear to have been Toolachs of exceptional pace, and probably in this species, as in most others of the genus, there was a marked sexual difference in this regard, the adult female being considerably slimmer, more lightly built, and fleetier than the male at a comparable stage of growth. In making these comparisons it is well to bear in mind also that the greyhound is exceeded in speed by very few of the monodelphian cursorial mammals. It is a somewhat striking attribute to the possibilities of the saltatory mode of progression, and a tribute which may be sufficient to acquit that mode of any inherent inferiority, that the little Toolach is able on occasion to hold its own with a breed of dog which has recently been shown to be capable, for short sprints, of the enormous speed of 42 miles per hour. The slight advantage in speed which the greyhound possessed in an open unobstructed run was to a large extent lost when the Toolach succeeded in gaining one of the belts of low scrub and tussocks which fringe the grass country. Here progress is only effected by frequent and abrupt changes of direction, and in avoiding obstacles at speed the bipedal, higher-jumping wallaby was far more adroit than the dog, and the escape of the former under these circumstances seems to have been regarded almost as a foregone conclusion.

Even more striking than its fleetness was the staying power of the Toolach and its ability to maintain a high speed over relatively long distances. This is a character which is not shared by many of the macropods. Of the larger kangaroos *M. rufus*, and, to a lesser extent, *M. giganteus*, are accustomed to covering great distances in moving from one feeding ground to another, and their tireless

endurance when allowed to adhere to a certain chosen and apparently almost effortless stride has excited the admiration of many observers. Further, the kangaroos, and some of the larger wallabies, under the influence of fright or the pain of a minor wound, are capable of amazing bursts of speed for short distances, but the respiratory apparatus of most species seems to be ill adapted to meet the strain of such effort for more than a few hundred yards, and a very noticeable and even abrupt slowing down then takes place. This fact is well known to kangarooers throughout the mallee, and in hunting the black-faced kangaroo with dogs it is during the ensuing period of partial but temporary exhaustion that most dogs of mixed breed make their kills; if the dog fails to close at this stage, a long chase ensues, in which (if he refrains from "sticking-up" to fight) the odds steadily increase in favour of the kangaroo.

The capabilities of *M. greyi*, however, seem to have been in a different category, and when flushed it almost at once attained a speed sufficiently great to extend the best of dogs, but this speed it continued to increase over a considerable distance, and even with greyhounds very long runs were the rule rather than the exception. Its endurance was strikingly illustrated during the ill-fated attempt to obtain living specimens at Konetta in 1923, and Mr. Edgar R. Waite, who was present, informs me that at one stage a pair was chased by a band of horsemen over the entire length of the paddock; they then turned short, retraced their course, with the pursuers still following, and finally, after a four-mile run, jumped a fence and passed within a short distance of their original starting point, with "speed apparently undiminished."

In the character of its stride, which is very long and low, and made with the greater part of its body extended in an almost horizontal direction, it was readily distinguished from *M. ruficollis*, which species, although usually frequenting a very different type of country, appears occasionally to have associated with *M. greyi*. In addition to this peculiarity of the individual leaps, however, it could be at once recognised also by certain features in its gait which are usually summed up in the statement that "it took two short hops and then a long one,"⁽³⁾ though less frequently the alternative "two long hops and a short one" is substituted. This impression of some irregularity in its progression has been so generally received by settlers in all parts of the district that there seems no doubt that it rests on a substratum of fact. The matter is not so simple, however, as is implied in the above statement, and to the obvious enquiry as to whether the two short hops were followed by a long one constantly, under all conditions, at all speeds, and over both open and unobstructed ground, I have received somewhat unsatisfactory and widely different answers. A minority of those questioned on the matter (and these not the least entitled by experience to credence) are of the opinion that any irregularity of the kind indicated was noticeable only when the Toolach was hotly pursued on rough ground; the long hop, according to these observers, did not recur at regular intervals, but was made only occasionally, and then at a sharp angle to the former line of flight. On this view it represented only a sudden change of direction either to avoid some obstacle or to embarrass the pursuer, a trick which is practised by all the kangaroos and wallabies to a greater or less extent, and in which the so-called "native hare" (*Lagorchestes leporoides*) has acquired an almost uncanny proficiency.

On the few occasions when the writer has been able to observe Toolaches under natural conditions, the observations were made at some distance and in country where the height of the undergrowth prevented any clear impression being received, and the single example which has been examined in captivity,

⁽³⁾ This statement is commonly modified by the settlers, who prefer to say that it took "two long hops and then a much longer one"; in this form, and embellished with suitable adjectives, it is a long-established joke in the Toolach country.

although almost constantly on the move, throws little light on the matter owing to the short distance which she has to traverse.

If it be true that the species did actually progress, either at all times, or under special circumstances only, by leaps which were of unequal length, but of definite sequence, it would appear to have possessed a trait unique among the Macropodidae and rich in speculative interest.

In discussing the saltatory habit of some of the small marsupials of Central Australia, Sir Baldwin Spencer (10) has suggested that an animal which proceeds by leaps and bounds may be less easily struck down by a bird of prey than one which progresses cursorially, and in view of the fact that the rapidly alternating movements in a vertical plane are greater in the case of an animal which hops than in the case of an animal which runs, this supposition would appear to be well founded. The plentiful occurrence and aggressive habits of the wedge-tailed eagle, in the habitat of the Toolach, has already been noted, and it seems not unreasonable to assume that the gait of the latter may have been acquired for the purpose of further increasing the difficulties of an attack from the air by adding an element of irregularity to the already undulatory character of its advance.

External Characters.—The early settlers were ill-disposed to see beauty in any of the native animals, but a partial exception was made of the Toolach, which is very generally spoken of with some approach to admiration, even by those who have played a leading part in its destruction. In a group which comprises several handsome animals it is a matter of difficulty, and one determined largely by individual taste, to assign pride of place to any one of them; still, it would be generally conceded that of the species which are sufficiently well established to be familiar, two are conspicuously well favoured—*M. parryi*, of the east, the claims of which to distinction rest largely on the elegance of its form; and *M. irma*, of the west, which is unrivalled in the striking yet harmonious character of its ornamentation, and, in considering the place of the Toolach, it may justly be said to share and blend many of the beauties of each.

The examination of Museum material, although it may suffice for the determination of gross external characters, conveys in the present case but a very inadequate impression of the animal in nature, and of the finer details of its general appearance and bearing, and for opportunities of observing these matters I am greatly indebted to Mr. J. Brown, of Robe, who, as already noted, possesses the only example of the species in captivity at the present time. This specimen is a female, apparently adult, and when captured was observed to have a large pouch young, which, however, most unfortunately she has failed to rear. At the time of my visit she was still exceedingly nervous and timid, and difficult to approach; but this, although adding greatly to the difficulties of photography, was no bar to observation, as the enclosure was small. In spite of this nervousness and agitation, she gives ample evidence of the intense curiosity which is so marked a feature in all the Macropodidae; her flights from the human intruder are of short duration, and if one remains quiet, are followed by periods when there is an obvious and amusing struggle between curiosity and fear, which adds not a little to the pleasure and interest of observation. In size this example is quite equal to the average adult female of *M. ruficollis typicus*, found in the same district, but the two species form a marked and interesting contrast in build and deportment. The Toolach is an exceedingly lithe and graceful wallaby, and all its movements are made with a delicate precision somewhat reminiscent of the rock wallabies. It is built on fine long lines, lending an air of slimness to its appearance, which is heightened by its erect carriage, and although the hind limbs are strongly developed and the fore limbs greatly reduced, there is less disproportion between the abdominal and thoracic portions of the trunk than commonly obtains, and which is so remarkable in the females of the kangaroos. The head is set on a

relatively long neck, and in its general relation to the shoulders as well as in certain intrinsic qualities is suggestive of *M. rufus*. It at once attracts attention on account of the very bold, sharply-defined cheek stripes (pl. xvi., fig. 2), the long, rufous-backed, pricked ears (which are less mobile than in many wallabies, and which are noticeably notched towards the extremity on the posterior margin), and the peculiar shape of the muzzle. This last is long, parallel-sided, and very deep from above downward, and it terminates somewhat bluntly in a large, naked, black rhinarium, the area of which is made to appear greater than it is by a half-inch wide border of black fur separating it from the light grey of the face, and by the circumstance that the median portion of the upper lip is also black. This departure from the somewhat rapidly tapering conical muzzle general in *Wallabia* and *Thylogale* confers a peculiar character on the physiognomy of the species which may be crudely expressed by saying that in a front view it appears always to be "looking down its nose."

The fore limb, as compared with that of *M. ruficollis*, *M. ualabatus*, *M. parryi*, and *M. agilis*, is short and feeble, and the manus is very small indeed; in that respect, and also in the shortness of the digits and the great relative breadth of the palm, it is very similar to that of *M. irma*. The small size of the forearm is disguised to some extent by its being clothed by fluffy, almost upright hairs, which are a glistening yellowish-white in colour, 25-30 mm. long, and sharply contrasted with the short grey fur of the proximal part of the limb and shoulder. At the carpus the long upright hairs are replaced abruptly by short yellow ones which, being closely adpressed, give the appearance of a sudden constriction at the wrist and contribute to the appearance of diminutiveness of the hand. This condition at once attracts attention in the living animal, and although it is very apparent also in all four filled skins which have been examined, appears not to have been previously described.

When moving at some speed its arms are pressed closely to its sides and chest, and the hands are then necessarily approximated; but apart from this, whenever it assumes the upright position, and, in fact, under almost all circumstances when not actually in use, the hands are brought forward away from the body and are held together, sometimes with the palm of one resting on the back of the other, but more usually with both palms together and the digits partially interlocking (pl. xvi., fig. 2).

The hind limb is large, but in the relative length of the femur and tibia (1:1.48) it shows no departure from the proportion existing in other large wallabies. Those who have closely examined and skinned many Toolaches assure me, however, that the shape of the foot was distinct from that of *M. ruficollis* (the natural standard of comparison in the district) in that it was bowed outward somewhat between heel and toes. I have not been able to observe this in the example under consideration and examination of the metatarsi of two part skeletons, and of the pes in filled skins, gives no indication of any such condition. The pes and its digits are slender and delicate, and the fifth toe is relatively long. The nail of the fourth toe is also conspicuously long, as noted by Gould and O. Thomas, but the statement of the former (5) that it exceeds in length that of all other wallabies is more generally correct when applied to *M. agilis*; the length of the central nail, however, is very inconstant, and subject to considerable variation in all species. The granular sole of the pes is continuous from the heel to the extremity of the fourth digit, but its width is not nearly uniform throughout its length as in other large wallabies, but is suddenly constricted to one-third of its breadth at a point about one-third of the total length from the heel, and it continues thus constricted for about an equal interval, widening again suddenly as it approaches the main interdigital pad. The condition is reminiscent of that obtaining in *M. rufus* and *M. giganteus*, except that the encroaching of the hair

from the sides of the pes is never sufficient to interrupt the continuity of the sole. The white thigh stripe is quite noticeable in the living animal (pl. xvii., fig. 1), but does not contrast as strongly with its background of light grey as in *M. agilis* and *M. dorsalis*.

The tail is but moderately long, rather thin, evenly tapering, and, for the greater part of its length, circular in section. Its most noteworthy feature is the conspicuous crest of long white hairs, which is erected from the dorsal surface of its distal third (pl. xvii., fig. 2). This crest has been little emphasised in previous descriptions. It is not mentioned by Gould, nor Wood Jones; Thomas (1) states that "indistinct upper and lower crests of white hairs developed on its distal half," and Waterhouse (8) states specifically that *M. greyi* "may be distinguished from *H. manicatus* by its having no crests to the apical portion of the tail." These discrepancies and partial oversights are probably due to the fact that once the skin is separated from the underlying muscles, the crest subsides to a considerable extent, and is thus less prominent in a filled skin than in life, and in a flat skin is easily overlooked. There may be, and probably are, variations in its relative development, but it is sufficiently constant to have attracted the attention of the early settlers, and is evident in all four skins in the South Australian Museum.

The exact condition of the pelage of the tail as it exists in the filled skin of an adult female (South Austr. Mus., Reg. No. M2121) is as follows:—The hairs on the dorsal surface of the base of the tail are very long (45-50 mm.), grey-fawn at the base, ashy-grey terminally and loosely packed. There is no sudden transition from body hairs to specialized tail hairs, as is usual in *Macropus*, but proceeding distally there is a gradual increase in coarseness and degree of adpression till a point about 150 mm. from the base is reached, from which its texture remains unchanged to the tip, but throughout the whole of its length the degree of adpression is less than in other wallabies of the group. At or about the 150 mm. point also, the superficial ashy-grey becomes more fawn, but from here, distally, the basal portion of all the hairs is dark brown or black. From the mid-point of the dorsal surface the hairs lengthen so gradually that it is difficult to define the length of the crest, but the erection of the hairs above the general surface of the tail becomes obvious 150 mm. from the tip, and for the terminal 50 mm. the hairs are 40 mm. long, uniform pale yellowish-white in colour and considerably elevated. The hairs of the ventral and lateral surfaces are generally short and stiff as in other species, but there is a distinct lengthening for the terminal 50 mm., which, however, is not accompanied by any considerable elevation, and which, therefore, does not result in a brush or tuft, as in *Petrogale*, nor in a second ventral crest as in *M. irma*.

The tail is very flexible and capable of greater and more varied movement than in other members of the genus that I have observed at close quarters, and when the animal is apprehensive, the terminal third is sometimes lifted just clear of the ground and is rapidly flicked from side to side, in the manner of an angry cat. Even during the course of its immense leaps and when still in mid-air this flexibility seems to be in part retained, and in place of being held rigid and strongly convex to the ground surface, it remains almost straight, and has the appearance of streaming out behind (pl. xvii., fig. 1). The same characteristic is noticeable in the tails of the *Petrogale*.

One of the most interesting and curious of its external characters is the transverse banding of the dorso-lumbar region, and this is also one of the many characters which it shares with *M. irma*, and it is somewhat remarkable that in neither case were the bands noticed, or at least commented on, by the original describer. It is true that they are somewhat obscured in flat skins, and that their visibility varies with the position of the observer, but they are unmistakably present in all skins of both species which I have examined, and this in the winter as well

as in the summer pelage. Gilbert (11), whose observation was generally both keen and accurate, and who was well acquainted with the western species in its native habitat, gives no indication of being aware of the banding in his notes on *M. irma* in 1844. In the case of *M. irma* the omission was made good by Kreffit (12) in 1871, and, in the case of *M. greyi*, by Wood Jones (4) in 1924. In the living animal the banding of the back is very prominent, and at once attracts attention, but the exact condition existing I have not been able to ascertain owing to the difficulties of a close approach.

In the filled skins in the South Australian Museum there is a substantial, though not absolute agreement, in the main features of the banding, and the description of the example in which they are most marked is applicable, with very slight modification, to them all. In this skin (that of an adult female, Reg. No. M2121) twelve bands of alternate light and dark-grey are visible in a posterior view, arising, as stated by Wood Jones, slightly anterior to the costal margin and continuing to the base of the tail. Of the series, six in the anterior lumbar region are much better defined than the remainder, and here the light bands are twice as wide as the dark. Their visibility varies greatly with the incidence of the light, and they are at all times plainest when the illumination is diffused or even dull. The banding seems to be produced chiefly by an alternating difference in the length of the fur, the light bands corresponding to areas of long hairs, the dark bands to areas of short hairs, and in certain lights the presence in the general surface of the coat of these elevations and depressions causes a shadow effect in the latter. In addition to this, however, the black-tipped hairs which are present over the whole of the dorsal surface show a tendency to concentrate in the narrow valleys. The invasion of the lateral surface by the bands is nowhere very considerable, but is greatest in the anterior portion of the series; those at the hinder end approaching the tail are the shortest, and are not visible in a side view. The unilateral slip in the pattern, which has been emphasised by Wood Jones (4) as of frequent occurrence in banded marsupials of several families, is not here apparent, but it may be pointed out that the bands are not strictly transverse to the long axis of the trunk through the whole of their length, but approach the dorsal mid-line somewhat obliquely, and thus acquire a slightly boomerang outline when viewed from behind.

Cranial Characters.—Five skulls have been available for examination (South Austr. Mus., Reg. Nos. M1760, M1761, M1762, M2120, M2121), and of these the first four form a fairly uniform series as to relative dimensions and general outline, although two only (M1762 and M2121) are adult in the sense that the permanent premolar has erupted.

In the high facial index, the wide unconstricted interorbital region, the relatively complete palate and the extremely small size of the second and third incisors, the main cranial characters enumerated for this species by Oldfield Thomas (1) are very evident. The latter author, however, states that the nasal bones "are short, broad, and enormously expanded behind." In all four of the skulls enumerated above the whole of the muzzle region, and with it the nasals, is very long, and although the posterior expansion is considerable in all, it cannot be described as enormous in any one of them. In the two slightly immature skulls the expansion may be said to be marked as compared with other large wallabies, but it falls considerably short of the condition figured by Thomas, and in the two adults is scarcely greater than frequently occurs in *M. ruficollis*. With regard to the length of the nasals, it is apparent from the measurements given by Thomas that the term "short" can hardly apply. The mean value of the ratio of the length of the nasals to the basal length of the skull in the two examples measured by him is 2.00, which is less than the value of the same ratio in *M. irma* and *M. agilis* (2.02 and 2.15, respectively), both of which are said to have long nasals. In the

two adult skulls in the South Australian Museum the ratio has fallen to 1.98, which indicates in *M. greyi* a relative length of the nasals greater than that of any other species of the subgenus.

It is very noticeable in all five skulls that the teeth are in excellent condition; not only is there an almost complete freedom from the usual incrustation of the molars, but all the teeth, both cheek teeth and incisors, show very little signs of wear. In most of the species of all three groups of *Macropus* the wear on the incisors is so considerable that, by the time the last molar is in place, the enamel of the first incisor has been reduced to two-thirds, or even one-half, of its original area. In the two adult skulls at hand, however, although the fourth molar has been in use for some time the size and shape of the first incisors show no modification from that of the same teeth in the three immature skulls. In all, the enamel surface of the tooth extends to the alveolar margin without disclosing any sign of the dentine root. This long duration of the incisors is no doubt correlated with the marked preference of the Toolach for a grazing, rather than a browsing, habit.

In connection with the teeth it may also be noted that in one skull (M2121) the appearance of the permanent premolar has been delayed to such an extent that it has been preceded in the jaw by the fourth molar. Using the British Museum Catalogue nomenclature, it may be said that in the right upper jaw of this skull, P³ and MP⁴ coexist with M⁴, while P⁴ is still beneath the bone. This extraordinary condition is of rare occurrence in *Macropus*, and the only other example of it which I have observed was presented by a skull of *M. irma*.

From a consideration of the general characters of the skull and its dentition Thomas (1) has advanced the view that *M. greyi* is in reality "a comparatively recently enlarged member of the group of small wallabies," and there is some support for his contention in certain of its habits. This is particularly true of its semi-gregariousness and localised, discontinuous distribution throughout its range, which are both strongly reminiscent of the mode of occurrence of the small wallabies.

Within the limits of the subgenus *Wallabia* its relationships are undoubtedly closest to *M. irma*, as pointed out by both Gould and Waterhouse. In the skull this is evinced by the diminutiveness of the second and third incisors, but the retention of a broad unconstricted interorbital region throughout life, and by the relatively complete palate. Externally it is shown in the great reduction in the size of the fore limb and manus, by several peculiarities in the structure of the pes, by the presence of a caudal crest, and by a general correspondence in the details of their ornamentation, this last being especially marked in the common possession of a system of loin bands absent in all other species of the genus *Macropus*, and paralleled by only one other species in the entire family Macropodidae.

M. irma is a western species which to-day is isolated from *M. greyi* by an immense tract of country totally unfitted as a habitat for either, and it is of considerable interest, therefore, that the affinities of the latter should be with the isolated *M. irma* rather than with the five other species, whose several habitats in Eastern Australia are practically continuous with one another, and linked also with its own.

According to the views of Bensley (13) the mutual relationships of the two species are not derivative, but are to be attributed rather to the parallel and quite independent evolution of two Large Wallabies from a common ancestral Small Wallaby, probably *Thylogale eugenii*. The explanation is an attractive one, but its unreserved acceptance is not without difficulties, and further enquiry is hampered by the fact that the *Thylogale* of the South Australian mainland has been exterminated before its identity was properly established.

SKULL MEASUREMENTS OF *MACROPUS GREYI*, IN S.A. MUSEUM.
(In millimetres.)

	M1760. Imm. (no sex)	M1761. Imm. (no sex)	M1762. Male. Adult.	M2121. Female. Adult.	M2120. Male. Imm.
Greatest length	120	119	124	124	98 (ca)
Basal length*	101	101.5	109.5	110	82 (ca)
Zygomatic breadth	60	58	59	58	58
Nasals, length	51	53	57.5	56	42
Nasals, greatest breadth ..	20.5	24	22	21	18
Nasals, overhang	9	10	9	9	—
Depth of muzzle†	22	23	27.5	24.5	20
Constriction	20.5 (inter-orbital)	21.5 (inter-orbital)	18 (inter-temporal)	21.5 (inter-temporal)	—
Palate, length	66	68.5	73.5	73	52
Palate, breadth inside M ² ..	21	21.5	23	22	17
Palatal foramina	7	7	6.5	8	—
Diastema	30	31	33	34	—
Basi-cranial axis	29	28	31	31	25
Basi-facial axis	76	77.5	82.5	83	60
Facial index	262	277	266	267	240
Molars 1-3	20	20	19.5	19.5	—
P ⁴	—	—	6	—	—
I1 } Antero-posterior length	11 x 4.5	12 x 4.5	10.5 x 5	11.5 x 4.5	—
I2 } x vertical height	5 x 3.5	4.5 x 3	4.5 x 3	5 x 3	—
I3 } (of enamel)	5.5 x 4	4.5 x 3.5	4.5 x 4	4 x 4.5	—

*From the anterior margin of the *foramen magnum* to the most anterior point on the *premaxillae*.

†Measured by a perpendicular through the mid-point of the diastema.

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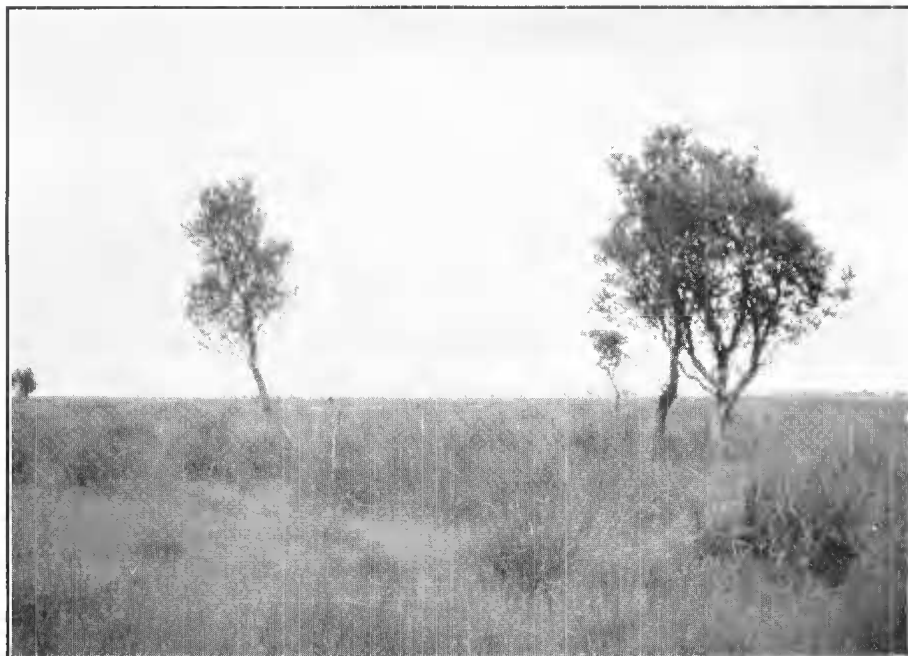


Fig. 1.
Typical "Toolach country," County of Grey, South Australia.

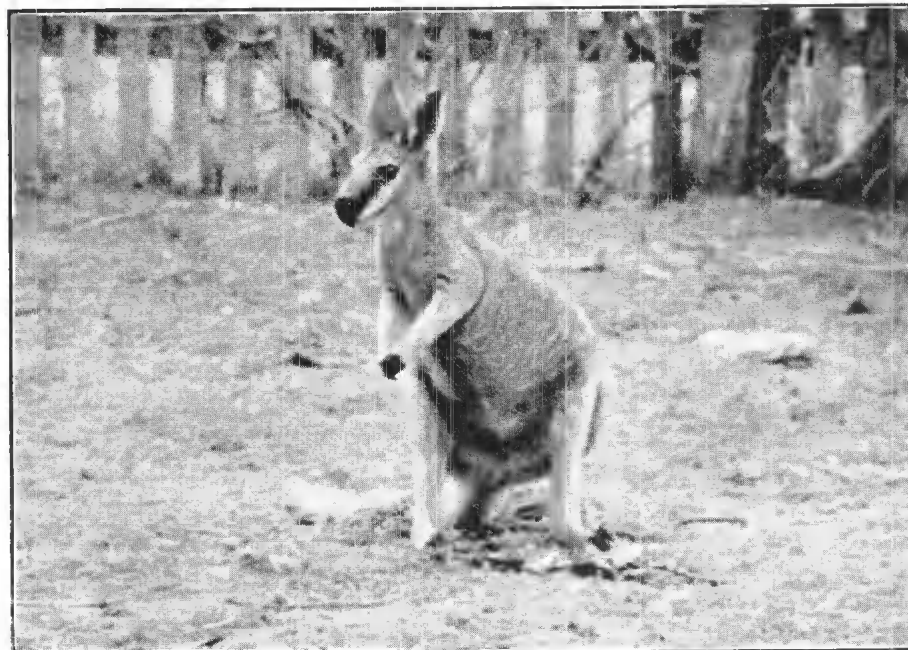


Fig. 2.
M. greyi (adult female), showing characters of head and usual position of hands.